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Symposium: Better Ceramics Through Chemistry III, Vol. 121

12. PERSONAL AUTHOR(S)
C. Jeffrey Brinker, David E. Clark, Donald R. Ulrich

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Sol-gel, ceramic precursors, films, superconductors, $^{29}Si$ NMR, polymerization, hydrolysis, insitu characterization, chemical synthesis

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This third MRS symposium on Better Ceramics Through Chemistry was held April 5-9, 1988 in Reno, Nevada. It was intended to unite chemists and physicists with ceramists and material scientists in order to synthesize new and better ceramic materials by solution routes involving molecular precursors. This year's symposium was distinguished from the previous two by several factors: (1) the participation of a greater number of chemists and chemical engineers; (2) more extensive use of in situ methods of characterization; (3) emphasis on sol-gel derived films; and (4) the inclusion of a session on "Better Superconductors Through Chemistry." → contd last page →

Highlights included the session on sol-gel chemistry of silicates where lively discussions focused on evidence for thermodynamic versus kinetic control in silicate polymerization pathways. Silicate speciation and hydrolysis and condensation kinetics were elucidated in several studies using $^{29}Si$ NMR, the most sophisticated approach employing 2D INADEQUATE $^{29}Si$ NMR. In addition to NMR, other in situ methods discussed in

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| 22a. NAME OF RESPONSIBLE INDIVIDUAL<br>Dr. Donald R. Ulrich | 22b. TELEPHONE (Include Area Code)<br>(202) 767-4963 |
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the characterization and poster sessions included small angle scattering, photo-physical probes, surface acoustic wave (SAW) techniques, cryogenic transmission electron microscopy (TEM), $^{1}H$ spin relaxation, and positronium decay.

In the session on films, ellipsometric imaging was employed to study film formation in situ. An approach to thick (>1μm) films based on organic modification was presented, and an approach to novel zeolite/gel composites for sensor surfaces was described.

Over 300 conferees were in attendance for several of the seminars including sol-gel chemistry and superconductors.

AFOSR-TR- 89-0444

COMPLETED PROJECT SUMMARY

1. TITLE: Symposium on "Better Ceramics Through Chemistry III"

2. PRINCIPAL INVESTIGATORS:

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3. INCLUSIVE DATES: 4/1/88 - 3/31/89

4. GRANT NUMBER: AFOSR 88-0145

5. COST AND FLY SOURCE: 20,395 FY 88

6. SENIOR RESEARCH PERSONNEL: NONE

7. JUNIOR RESEARCH PERSONNEL: NONE

8. PUBLICATIONS: Symposium Proceedings entitled "Better Ceramics Through Chemistry III" edited by C. Jeffrey Brinker, David E. Clark and Donald R. Ulrich, Vol. 121, Materials Research Society, Pittsburgh, Pennsylvania, 1988.

9. ABSTRACT OF OBJECTIVES AND ACCOMPLISHMENTS:

This third MRS symposium on Better Ceramics Through Chemistry was held April 5-9, 1988 in Reno, Nevada. It was intended to unite chemists and physicists with ceramists and material scientists in order to synthesize new and better ceramic materials by solution routes involving molecular precursors. This year's symposium was distinguished from the previous two by several factors: (1) the participation of a greater number of chemists and chemical engineers; (2) more extensive use of in situ methods of characterization; (3) emphasis on sol-gel derived films, and (4) the inclusion of a session on "Better Superconductors Through Chemistry."

Highlights included the session on sol-gel chemistry of silicates where lively discussions focused on evidence for thermodynamic versus kinetic control in silicate polymerization pathways. Silicate speciation and hydrolysis and condensation kinetics were elucidated in several studies using $^{29}Si$ NMR, the most sophisticated approach employing 2D INADEQUATE $^{29}Si$ NMR. In addition to NMR, other in situ methods discussed in the characterization and poster sessions included small angle scattering, photophysical probes, surface acoustic wave (SAW) techniques, cryogenic transmission electron microscopy (TEM) $^{1}H$ spin relaxation, and positronium decay.

In the session on films, ellipsometric imaging was employed to study film formation

in situ. An approach to thick (> 1 μm) films based on organic modification was presented, and an approach to novel zeolite/gel composites for sensor surfaces was described.

Final Technical Report

Dr. C. Jeffrey Brinker
Dr. David E. Clark
Dr. J. B. Ballance

The original intention was to establish a forum for uniting ceramists and chemists in order to synthesize ceramics with new or improved properties by chemical procedures that allow control of the structure on a moleuclar level. The success of the symposium does not rely only on the collaboration of ceramists and chemists, however. Better Ceramics Through Chemistry is truly an interdisciplinary topic that has benefited greatly by contributions from physicists, polymer scientists, geologists, chemical engineers, microscopists, etc. Certainly a multidisciplinary approach is essential to making yet further progress in this excitiing field.

Principal topics included sol-gel routes for preparing oxides, powder processing, and non-oxides. However, this symposium was distinguished from the prior ones by emphasizing thin film formation, high $T_{sub}$ superconductors, and in-situ methods of characterization. Highlights of the symposium included the session on Sol-Gel Chemistry of Silicates where lively discussions focussed on evidence for thermodynamic versus kinetic control in silicate polymerization pathways. Silicate speciation and hydrolysis and condensation kinetics were elucidated in several studies using $^{29}Si$ NMR, the most elegant approach employing 2D INADEQUATE $^{29}Si$ NMR. In addition to NMR other in-situ methods discussed in the Characterization and Poster sessions included small angle scattering, photo-physical probes, surface acoustic wave (SAW) techniques, cryogenic TEM, $^{1}H$ spin relaxation, and positronium decay. In the session on Films, ellipsometric imaging was employed to study film formation in-situ. An approach to thick (1 nucrometer) films based on organic modification was presented, and novel zeolite/gel composites for sensor surfaces were described. About 130 papers were presented either orally or as posters.

Keywords: thin films; thick films; ceramics; Nuclear magnetic resonance; zeolite gel composits; (KT)